

ordinary skill in the art would have modified the iron catalyst disclosed by *Dewdney et al.* in the manner necessary to arrive at applicants' invention because *Lee et al.* and *Nam et al.* teach that iron-manganese catalysts provide for better stability and selectivity.

It is respectfully noted that *Lee et al.* and *Nam et al.* investigate Fe-Mn catalysts wherein the atomic ratio of Fe:Mn is 9:1<sup>3)</sup> which corresponds to about 10% by weight of manganese based on the amount of iron. Applicants' catalytic composition comprises manganese in an amount of from 0.001 to 1% by weight, based on the iron component (a). A person of ordinary skill who modified the iron catalyst of *Dewdney et al.* in light of the Fe-Mn catalysts addressed by *Lee et al.* and *Nam et al.* would, therefore, not have arrived at the catalysts which are defined in applicants' independent Claims 21 and 33 and further specified in the dependent claims. One of the three basic criteria which must be met for establishing a *prima facie* case of obviousness is that the prior art reference or the combined references must teach or suggest all of the claim limitations. This criterion is clearly not met where the teachings of *Dewdney et al.*, *Lee et al.* and *Nam et al.* are concerned.

Another of the three basic criteria which must be met for establishing a *prima facie* case of obviousness is that the reasonable expectation of success must be found in the prior art. This criterion is also not deemed to be met where the teachings of *Dewdney et al.*, *Lee et al.* and *Nam et al.* are concerned. The "better stability and selectivity" according to the teachings of *Lee et al.* and *Nam et al.* is found when the Fe-Mn catalyst is employed in the hydrogenation of CO<sub>2</sub> to hydrocarbons. According to the investigations reported by *Lee et al.*<sup>4)</sup>, the Fe-Mn catalyst is, under the conditions of -and in the presence of the materials encountered in- the CO<sub>2</sub> hydrogenation, less prone to be deactivated than an Fe catalyst<sup>5)</sup>. The selectivity improvement which is addressed by *Lee et al.* and *Nam et al.* equally pertains to the catalytic hydrogenation of CO<sub>2</sub>, and refers to the capability of the catalyst to produce olefins or to produce saturated hydrocarbons. In accordance with the teaching of *Nam et al.*<sup>6)</sup>, the

3) *Can. J. Chem. Eng.* page 512, col. 1, first paragraph, and *Energy Convers. Mgmt.* page 5398, lines 4 and 5 of the section "Experimental".

4) The disclosure of *Nam et al.* does not provide information pertaining to the "stability" of the investigated catalysts.

5) *Can. J. Chem. Eng.*, paragraph bridging pages 514 and 515.

6) *Energy Convers. Mgmt.* page 5400, Table 1.

hydrogenation product which is obtained in the presence to the Fe catalyst contains olefins "CO" and saturated hydrocarbons "CH" in a ratio of CO:CH of about 36:64, whereas the CO:CH ratio is about 8:92 when the Fe-Mn catalyst is used. In contrast to those findings, *Lee et al.* state that "the presence of manganese does not show obvious effects on the distribution of hydrocarbon products"<sup>7)</sup> and illustrate a CO:CH ratio in the hydrogenation product of 16.8:3.6 for the Fe catalyst, and a CO:CH product ratio of 18.7:4.0 for the Fe-Mn catalyst<sup>8)</sup>.

The teaching of *Dewdney et al.* is not concerned with the catalytic hydrogenation of CO<sub>2</sub>. Rather, the catalyst employed by *Dewdney et al.* is specifically adapted for the catalytic hydrogenation of adiponitrile. Due to the distinct differences in the materials employed and the products obtained, the hydrogenation reactions investigated by *Lee et al.* and *Nam et al.* cannot be regarded as an equivalent of the hydrogenation of adiponitrile which is addressed by the teaching of *Dewdney et al.* Accordingly, the stability finding of *Lee et al.* which pertains to the hydrogenation of CO<sub>2</sub> cannot reasonably be deemed to apply under the conditions of the catalytic hydrogenation of adiponitrile according to the teaching of *Dewdney et al.* For the same reasons, the selectivity behavior which pertains to the hydrogenation of CO<sub>2</sub> cannot reasonably be deemed to apply under the conditions of the catalytic hydrogenation of adiponitrile according to the teaching of *Dewdney et al.* A person of ordinary skill in the art would therefore not consider the findings of *Lee et al.* and/or *Nam et al.* as an indication for the catalyst's behavior in the hydrogenation of adiponitrile. Correspondingly, a person of ordinary skill in the art would not be motivated by the teachings of *Lee et al.* and/or *Nam et al.* to modify the catalyst of *Dewdney et al.*, especially since *Dewdney et al.* teach that it is preferred -with regard to the catalytic hydrogenation of adiponitrile- that no metal compounds other than iron oxide be added to the catalyst precursor material<sup>9)</sup>.

In light of the foregoing, two out of the three criteria for establishing a *prima facie* case of obviousness are not met where applicants' invention and the teachings of *Dewdney et al.*, *Lee et al.* and *Nam et al.* are concerned. It is therefore respectfully requested

---

7) *Can. J. Chem. Eng.*, paragraph bridging pages 514 and 515.

8) *Can. J. Chem. Eng.*, page 513, Table I.

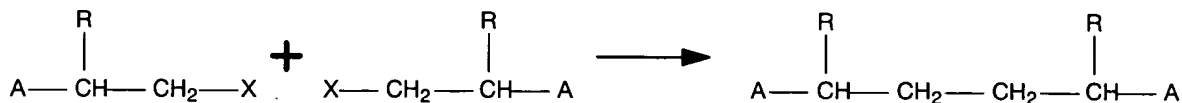
9) Note col. 2, indicated lines 60 to 64, of *US 4,064,172*.

that the rejection of Claims 21 to 40 under Section 103(a) based on the teaching of *Dewdney et al.* when taken in view of the disclosures of *Lee et al.* and *Nam et al.* be withdrawn. Favorable action is solicited.

The Examiner has rejected Claims 21, 22, 27, 34 and 35<sup>10)</sup> under 35 U.S.C. §103(a) as being unpatentable in light of the teaching of *Dewdney et al.* when taken in view of the disclosure of *Ansmann et al.* (DE 101 51 559). It is respectfully noted that the secondary reference was first published in 2003 and is, therefore, not prior art to the present case. Withdrawal of the respective rejection is therefore solicited.

The Examiner has rejected Claims 21, 27 to 33 and 38 to 40 under 35 U.S.C. §103(a) as being unpatentable in light of the teaching of *Dewdney et al.* (US 3,986,985<sup>11)</sup>) when taken in view of the disclosure of *Onsager* (US 3,644,477). In this context, the Examiner argues that a person of ordinary skill in the art would have modified the iron catalyst disclosed by *Dewdney et al.* in the manner necessary to arrive at applicants' invention because *Onsager* teach the use of promoter salts, including salts of V and Mn, and because *Lee et al.* and *Nam et al.* suggest that manganese provides stability and selectivity.

It is respectfully noted that disclosure of *Onsager* pertains to a coupling reaction according to the following reaction equation<sup>12)</sup>:



rather than the hydrogenation of adiponitrile to produce hexamethylene diamine as taught by *Dewdney et al.* Also, rather than modifying the metal catalyst, *Onsager* teach that the reaction be conducted in the presence of promoting salts which are soluble in the reaction system<sup>13)</sup>. In light of the different reactions which are addressed by

10) It is respectfully noted that Claims 34 and 35 depend on Claim 33, and Claim 33 was not included by the Examiner in this rejection. However, if an independent claim is non-obvious under 35 U.S.C. §103, then any claim depending therefrom is non-obvious (*In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (CAFC 1988)). Claims 34 and 35 should therefore also be non-obvious under 35 U.S.C. §103.

11) The Examiner subsequently references statements made by *Dewdney et al.* in US 4,064,172 which is a division of US 3,986,985. Applicants' remarks pertaining to US 4,064,172 in the foregoing equally apply here.

12) For example, col. 2, indicated lines 34 to 45, of US 3,644,477.

13) For example, col. 4, indicated lines 12 to 27, and indicated lines 28 to 33, of US 3,644,477.

*Dewdney et al.* and by *Onsager*, the teaching of *Onsager* cannot be considered to constitute analogous art, cf. art which is either in the field of the applicant's endeavor, or, if it is not, is reasonably pertinent to the particular problem with which the applicant was concerned<sup>14</sup>). A person of ordinary skill in the art would therefore not have been motivated to modify the catalyst taught by *Dewdney et al.* based on information obtained from the teaching of *Onsager*. The same applies, as addressed in the foregoing, where the teachings of *Lee et al.* and *Nam et al.* are concerned. Applicants accordingly respectfully request that the rejection under Section 103(a) based on the teachings of *Dewdney et al.* and *Onsager* be withdrawn. Favorable action is solicited.

Please charge any shortage in fees due in connection with the filing of this paper, including Extension of Time fees, to Deposit Account No. 11.0345. Please credit any excess fees to such deposit account.

Respectfully submitted,

KEIL & WEINKAUF



Herbert B. Keil

Reg. No. 18,967

1350 Connecticut Ave, N.W.  
Washington, D.C. 20036  
(202) 659-0100

HBK/BAS

---

14) *In re Oetiker*, 977 F.2d 1443, 1446, 24 USPQ2d 1443, 1445 (CAFC 1992). See also *In re Deminski*, 796 F.2d 436, 230 USPQ 313 (CAFC 1986); *In re Clay*, 966 F.2d 656, 23 USPQ2d 1058 (CAFC 1992); and *Wang Laboratories Inc. v. Toshiba Corp.*, 993 F.2d 858, 26 USPQ2d 1767 (CAFC 1993).